DSC Space-Based Radar 120-Day Study Plan

Background: The Joint C4ISR Decision Support Center (DSC) Senior Steering Group (VCJCS, C3I, and AT&L) has authorized a 120-day study to evaluate an initial analysis of the military utility of Space-Based Radar (SBR). This study plan outlines the objective, scope, analysis plan, and study organization to be used in this effort.

1.0 Study Objective

The primary objective of this study is to evaluate the military utility of SBR. Since no current SBR architecture exists, the study will develop and quantify key functional aspects or drivers of any SBR architecture in terms of utility to the military. As much as possible, the study will be architecture neutral; the key functional aspects will be treated as parameters that are then evaluated in terms of specific metrics that indicate military utility.

The insights obtained in this study will be applicable in the generation of formal requirements, architecture analysis, and analysis of alternatives. Key functional performance parameters will be established together with thresholds and metrics to evaluate the best military utility in terms of combinations of these parameters. The study will provide a government sponsored method to evaluate military utility that can be used when specific contractor architectures or alternatives are evaluated. It is expected that the same approach will be applicable to the evaluation of airborne providers of ground moving target indicator (GMTI), synthetic aperture radar (SAR), and digital terrain elevation data (DTED) information, although airborne evaluations are not a part of this study.

A key study objective is to provide a result based on the joint input of the services that includes a wide range of potential SBR military applications.

2.0 Scope

The study will be focused on the space-based provision of GMTI, SAR and DTED. The emphasis will be on the theater-wide tracking and identification of surface targets but the study will also provide insights on global utility of SBR to perform persistent all weather surveillance. SBR will be evaluated in the context of full intelligence, surveillance, and reconnaissance (ISR) from multiple intelligence disciplines (multi-INT; i.e., SIGINT, IMINT, MASINT, HUMINT, OSINT) that are expected during the 2010-2015. The DSC will leverage on analytical methodolgies utilized in previous studies modified to provide a top-down approach to the military utility of SBR.

3.0 Essential Elements of Analysis

The DSC study will answer the following questions:

1) What are the key measures of military utility, to include persistent global surveillance?

2) What are key functional performance parameters for SBR in terms on military utility?

3) What are the sensitivities of these parameters in terms of military utility?

4.0 Methodology

A top down methodology is required in this case since specific SBR architectures are not available. This method focuses on the military utility requirements first and not on the engineering required to provide any specific GMTI/SAR capability.

4.1 Metrics

A special set of metrics has been developed for this approach. Metrics are as follows:

Measures of Outcome (MOOs) – measure military utility directly by calculating traditional Blue lethality and Blue survivability metrics together with more generalized metrics. The central question is how key SBR functional parameters impact these metrics.

Measures of Effectiveness (MOEs) – measure the completeness of information provided by ISR to the military commander*. Examples are Battlespace Awareness, Targeting and Battle Damage Assessment (BDA) information, Intelligence Preparation of the Battlespace (IPB), and Indications and Warnings (I&W).* IPB and I&W will be extrapolated from local battlespace capabilities to global capabilities to provide insight to the global utility of SBR.

Measures of Functional Performance (MOFPs) – key functional performance aspects of potential SBR architectures*. An example is expected maximum track duration*. These are aggregated groups of more detailed performance parameters but are intended to capture essential capabilities of SBR that can be expressed as drivers in an architecture. *The study will provide military utility measures in terms of these parameters.*

Measures of Performance (MOPs)– detailed performance parameters of SBR architectural performance. *An example is gap time*. Although the study will not evaluate specific architectures, a set of exemplar architectures, provided by the Aerospace Cooperation, will provide information of the potential ranges of these parameters. These exemplar architectures are: LEO (low-earth orbit), MEO (medium-earth orbit), and a bistatic MEO. These parameters, although not used

explicitly in the study outcome, must be evaluated to make sure that the MOFPs (above) are properly constructed.

4.2 Analysis Method

SBR utility will be calculated in terms of combinations of the MOFPs. Also evaluated are *a priori* levels of SBR performance that can be used to see the total contribution of SBR to the military outcome. This will provide a total range of any potential SBR architecture. The analysis objective is to present a "scale" that shows the military utility of the following:

a) *A priori* levels of SBR performance (e.g., perfect (to be refined) SBR, no SBR)
b) SBR functionality built from combinations of MOFPs
c) Results from the exemplar architecture reference above.

MOEs (e.g., Situation Awareness) will also be evaluated in terms of MOFPs (and MOPs where applicable) to show sensitivities of those parameters. A wide range of sensitivities will be evaluated. Information from selected "best" MOE cases will be used to evaluate MOOs in the full multi-ISR scenario case.

The analysis product will give the key SBR functional parameters, and sensitivities of military utility to these parameters. This is the information that will expose the SBR drivers and requirements for later evaluations.

An associated briefing has been created that gives the analysis methodology with greater specificity and is available on request.

4.3 Missions to be evaluated:

SBR utility (i.e., MOO calculations) will be evaluated for the following military missions:

- Dominant Maneuver
- Precision Engagement
- Joint Suppression of Enemy Air Defenses (JSEAD) / Theater Ballistic Missile
- Naval mission (TBD)
- Special Operations Forces (SOF) / Counter-terrorism (TBD)
- Persistent global surveillance (TBD)

Scenarios for evaluation will include Southwest Asia (SWA), Northeast Asia (NEA) and Regional Threat 2 (RT-2). These scenarios contain stressing problems of mobile, high interest targets located deep inside hostile areas together with a full major theater of war (MTW) ground campaign. Due to the short time available for this study these scenarios will be derived from previous DSC work. The naval mission will capture unique naval missions not already

contained in the Dominant Maneuver, Precision Engagement and JSEAD/TBM missions. Time-critical and time-sensitive targeting will be evaluated throughout these missions. The counter-terrorist mission is TBD.

5.0 Study Organization

The DSC will direct the study in conjunction with USSPACECOM and Joint Staff J8. As far as possible, the study will reflect a joint service view of SBR.

The DSC SBR study will utilize the efforts of a number of SBR experts in the community. This group, the core group, will provide the details of the military evaluation of SBR and present final study recommendations.

A Community Review Group made up of interested organizations in the DOD community will review the study progress and final product. This group will meet monthly and as required.

A Senior Review Group will review the final results of the study. DSC studies are normally reviewed by the DSC Senior Steering Group (AT&L, C3I & Joint Chiefs) and are briefed through the JRP, JRB and JROC.

6.0 Final product

The DSC SBR study will produce an executive summary and detailed set of annotated briefings. These will give the final description of key SBR architectural parameters justified in terms of military utility. Also provided will be insights in optimizing and using SBR, including effective tasking response.

7.0 Schedule

TBD. Study commenced 1 October 2001. Final product will be available in February 2002.